Integrated Forecast and Reservoir Management Implications for Climate Change

Konstantine P. Georgakakos

Public Comments

No public comments were received for this proposal.

Technical Synthesis Panel Review

Proposal Title

#0317: Integrated Forecast and Reservoir Management Implications for Climate Change

Final Panel Rating
inadequate

Technical Synthesis Panel (Primary) Review

TSP Primary Reviewer's Evaluation Summary And Rating:

Dr. Georgokakas and his colleauges have submitted yet another proposal to support the Integrated Forecast and Reservoir Management (INFORM) modeling effort. This modeling effort is already supported by three different agencies (CALFED, NOAA, and the California Energy Commission), and the work proposed in the current proposal seems to overlap considerably with the original INFORM objectives. The research tasks in the current proposal are (1) validation of the INFORM system; and (2) evaluation of the impacts of climate change on water management. Model validation should be a component of the existing INFORM project, and the applicants should not need additional funds to perform these tasks. Evalation of climate change impacts has also been performed by the applicants under their current funding. In short, there is nothing new in the current proposal, and, in the panels opinion, it is not worthy of funding.

Additional Comments:

Pertinent reviewer comments: (1) No indication the objectives are consistent

Dr. Georgokakas and his colleauges have submitted yet another

proposal to support the Integrated Forecast and Reservoir Management (INFORM) modeling effort. This modeling effort is already supported by three different agencies (CALFED, NOAA, and the California Energy Commission), and the work proposed in the current proposal seems to overlap considerably with the original INFORM objectives. The research tasks in the current proposal are (1) validation of the INFORM system; and (2) evaluation of the impacts of climate change on water management. Model validation should be a component of the existing INFORM project, and the applicants should not need additional funds to perform these tasks. Evalation of climate change impacts has also been performed by the applicants under their current funding. In short, there is nothing new in the current proposal, and, in the panels opinion, it is not worthy of funding.

Technical Synthesis Panel (Discussion) Review

TSP Observations, Findings And Recommendations:

The external technical reviewers differed in their assessment of this proposal, but the panel considered the proposed research to be technically sound. Dr. Georgokakas and his colleagues have produced excellent work. However, the proposed research overlaps substantially with currently funded research. For this reason, the proposed work could add only a small amount of additional useful information.

Technical Review #1

proposal title: Integrated Forecast and Reservoir Management Implications for Climate Change

Review Form

Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	**The goals, objectives and hypotheses are clearly stated in the proposal. The goal of the proposal is to assess the combined impact of twenty first century climate change and increased water demand on the water resource management for Northern California. The stated hypothesis is that the coordinated management approach would increase the chances of predicting uncertainty in large water resource project compared to the existing management scenarios. In other words, the system of large reservoirs utilizing state of the science projections with associated uncertainty will increase substantially water resource system resilience to projected future climate and water demand changes. Because of increased in population, changes in environmental conditions, and unprecedented increase in emissions of CO2 in the atmosphere, there is a clear indication of climate change in the world and the change cannot be ignored to the area proposed in the proposal. The idea is scientifically and logically stated in the proposal. The raised issue is important and needs to be addressed on time.**
Rating	**excellent**

Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection

of research, pilot or demonstration project, or a full−scale implementation project justified?

Comments	**The study incorporates the validation of Integrated Forecast and Reservoir Management (INFORM) system, which was developed for the real time forecast and management decisions in order to ensure the reliable assessment using projected climate change and water demand change scenarios. Moreover, the proposal has stated the use of real time data and incorporation of probabilistic changes in hydrological sequences due to the change in climate and water demand scenarios. They have proposed to use high temporal and spatial resolution data, which is of importance for the selected area like Northern California that would only incorporate the details of the hydrological events in the models. Thus, the spatial as well as temporal uncertainty of the precipitation events, soil moisture changes, vegetation changes can be incorporated in the study. The selection of the project, the study area, and the demonstrations are justified in the proposal.**
Rating	**excellent**

Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	**They have proposed high resolution dynamical−probabilistic downscaling method for the hydrologic processes. The validated hydrological model will also be implemented for the tributaries of the Sacramento watershed. The analysis of the management scenario change due to the change in climatic as well as probabilisitic future demand will also be made in the study. This is the important aspect of the proposal and the reviewer thinks that this is the timely issue that must be addressed so that the unprecedented future problems could be solved on time.**

	The adaptive dynamical reservoir operational rules will be based on the probabilistic change in future climatic scenarios as well as demands, which will help to formulate a set of management guidelines based on the rules. This is another innovative idea that the authors would like to incorporate in the proposed study. The approach of the study, i.e., INFORM validation plan consists of parallel operation of virtual and real INFORM system for selected periods in collaboration with operational forecast and management agencies. The performance comparison will be made based on mutually agreed upon performance criteria. The incorporation of flexible trade−off policies at a given reliability level, which will be determined from the forecast uncertainty, will hopefully help the decision makers to develop the adaptive decision making rules for reservoir operations. As stated in the proposal, the forecast component of INFORM downscales the information using statistical−dynamical models of the orographic precipitation and temperature with spatial resolution of 10 km and then the adjustment of the downscaled precipitation and temperature will be made based on observed historical records and monthly regressions. The downscaled adjusted ensemble values will be used as input to snow soil channel hydrology models, which will provide the ensemble flow predictions for the system under consideration. This approach is feasible and scientific as because the adjustment of biasness and unlikely future deviations have been taken care of based on historical records and monthly regressions.
Rating	**excellent**

Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	**The theoretical and modeling framework of INFORM has already been accomplished and the proposed task**

	incorporates the real time validation of the developed INFORM system by incorporating the climate and water demand change scenarios for Northern California. Preliminary results shown in the proposal (e.g., right panel of Figure 4) are convincing. The results indicated the future success of the project regarding with the incorporation of the probabilistic change of the future climate and water demand scenario. Thus, the reviewer thinks that the likelihood of the success of the project is very high. The approach is fully documented in the form of various tasks. For example, task 3 illustrates the validation of downscaled precipitation and temperature forecasts for both short term as well as long term basis. The deliverables of each task have been clearly mentioned in the proposal, which are realistic and within the grasp of authors. Both major components e.g., INFORM forecast and INFORM DSS are clearly explained in the proposal.
Rating	**excellent**

Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	**The objectives of the project are to validate INFORM forecast and decision support system components by incorporating the future change in water balance due to climatic and demand change scenarios. The study will find new ideas to develop strategies for the decision makers to operate reservoirs, which will help to sustain the water resources demand supply system for next several years. The modeling results will find the precipitation and temperature variability over California as a consequence of large scale increase in tropospheric temperature and change in circulation patterns over North Pacific and western US.**
Rating	**excellent**

Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	**The anticipated products will be a number of technical reports that will help to solve the important policy questions like how can be addressed the likely future water demand because of model simulated trend of water demand change scenarios for next several decades. Again, how can climate and hydrology forecasts be used to improve the planning and management processes? What additional water resources would be necessary to augment the future water demand? Some insights of how can such demand will be probably be made? Such questions will be answered from the study. The reviewer realizes that under the task 8 as it is stated that the quantification of inter−annual relationships between demand and climatic conditions will be identified based on historical water demand requirements corresponding to observed bydro−climatic conditions. It would be better also to consider the impact of global climatic change to Northern California and its impact to demand change rather than the impact of demand to climatic change. As because, the climatic change is rather complex process and the water demand is very small portion of its overall system balance.**
Rating	**excellent**

Additional Comments

Comments

Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	**The personal form shows that Georgakakos, K. P. (PI) has eight refereed publications in past three years as a senior author and nine refereed publications as a junior author. The type and nature of the publications in the past is of similar nature to the proposed study. Graham, N. E. (Co−PI) has six refereed journal publications as a senior author and three refereed journal publications as a junior author at similar types of research required to fulfill the objectives of the proposed project. Georgakakos, A. P. (Co−PI) has five refereed publications and two conference proceedings as a senior author. Besides he has four publications as a junior author. The track record shows that the team is well qualified to efficiently and effectively implement the proposed project. HRC and GWRI are leading research institutes in the area of reservoir forecast and optimization. Hence, the infrastructure and other aspects of support necessary to accomplish the project have been justified.**
Rating	**excellent**

Budget

Is the budget reasonable and adequate for the work proposed?

Comments	**The budget allocation has been proposed according to the priority of each task as follows:** **Task 1: $39770=4.40% Task 2: $19882=2.20% Task 3: $92369=10.22% Task 4: $114383=12.65% Task 5: $126807=14.03% Task 6: $172400=19.07% Task 7: $73352=8.11% Task 8: $18143=2.00% Task 9: $102285=11.31% Task 10: $144212=15.96%**

	The proposed nature of the study for each task and the ratio of budget for each of them look reasonable.
Rating	**very good**

Overall

Provide a brief explanation of your summary rating.

Comments	**The expectations of the project are very clearly proposed and the authors have in-depth expertise for the type and nature of the proposed work. The study will help to add additional knowledge into the forecast and optimization of the reservoirs considering the probabilistic future changes in climatic as well as demand scenarios. Moreover, the study has addressed the likely future stress in demand-supply scenarios of water resources for Northern California and the mitigation measures for such problems would be possible using such tools like INFORM DSS as proposed in the study.**
Rating	**excellent**

Technical Review #2

proposal title: Integrated Forecast and Reservoir Management Implications for Climate Change

Review Form

Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	**The purpose and theme of the proposal is clear and consistent. The application of global scale climate predictions to regional climate models and fine−timestep models of hydrology and water system operation is an important issue, and one that has not been widely studied.**
Rating	**very good**

Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

Comments	**The proposed study is an appropriate "next step" in the investigation of predicted impacts of climate change on water resources. The conceptual model is clear and the need for the work is well explained.**
Rating	**very good**

Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to

generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	**The basic downscaling and water resources modeling approach has been applied before by the proposal authors and many others. The value of the work is in the integrated INFORM model, as applied to a polically challenging area. The information generated from the work will be very valuable to decision−makers, however, novel approaches, methodologies, and results are unlikely to be produced.**
Rating	**good**

Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	**The basic downscaling and water resources modeling approach has been applied before by the proposal authors and many others. Since the INFORM model has already been developed (by the authors), the authors will have no problems satisfying the objectives of the proposed work.**
Rating	**very good**

Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	**Not applicable**
Rating	**not applicable**

Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	**The information generated from the work will be very valuable to decision-makers, however, novel approaches, methodologies, and results are unlikely to be produced.**
Rating	**good**

Additional Comments

Comments

Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	**The assembled authors have excellent track records and have the intellectual and infrastructural capability to implement the proposed project.**
Rating	**excellent**

Budget

Is the budget reasonable and adequate for the work proposed?

Comments	**The INFORM model has already been developed and its results documented, so the 36-month timeline may be exaggerated. In my experience, work of this scale has taken 24 months.**
Rating	**fair**

Overall

Provide a brief explanation of your summary rating.

Comments	**Overall, this is a good proposal. While the approach and methodologies are not likely to be new, the results will be valuable to decision-makers. Since the basis of the INFORM model has already been developed, the proposed work is an appropriate, timely, and valuable extension of that work.**
Rating	**good**

Technical Review #3

proposal title: Integrated Forecast and Reservoir Management Implications for Climate Change

Review Form

Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	**I see no indication that the stated two objectives are consistent, as 1) They attempts to validate their model using real time data from 09/2005−09/2008, but they put a lot of efforts in discussing potential climate change over the next century. This gives me impression that they will predict the climate in century time scale, which is impossible to be achieved at this point. There are so many key questions unanswered. 2) Their model stated in this proposal has not been validated so far. How come can they use the model to assess the implications of climate changes. I note that their on−going project is directly related to this one, why not finish your on−going project first. I don't think it is timely and important at this stage.**
Rating	**fair**

Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

Comments	**I see no sign that the proposed research will add any useful knowledge to scientific communities. The climate is changing, and the water−demand is also**

	changing, how can you create a certain picture for the future.
Rating	fair

Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	No detailed discussion about their approach except managerial plan. They claim their model will be probablistic, but no stochastic process has been discussed. What is the range of uncertainty? I doubt this research will be informative or useful to decision makers.
Rating	fair

Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	Their approach likely fails as I see the uncertain of their model is pretty large (~20%, i.e., 15−18% in annual average ....) even using historical data. How can they be confident about their future projection?
Rating	poor

Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	No monitoring plan at all.

Rating	**poor**

Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	**Definitely, they will generate data and even publication, but I doubt these results are informative, either of practical or theoretical.**
Rating	**fair**

Additional Comments

Comments

Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	**They have done a lot of this-type research,and produced a lot of papers. I believe thay are qualified and have the infrastructure to do this research.**
Rating	**very good**

Budget

Is the budget reasonable and adequate for the work proposed?

Comments	**The budget is ok, which is very detailed.**
Rating	**very good**

Overall

Provide a brief explanation of your summary rating.

Comments	**Overall this project should not be supported until we have better knowledge about future climate changes at century-scales. Our present ENSO-related skills are benefited from an impoved understanding of decadal oscillations. Since we have learned little about the century-scale climatic oscillations, the decadal-scale projections will be of little value. GHG is one important component regulating the climate but not all. If the CO2(atm) really reaches to the 720ppm level, I believe another glacier time is closer.**
Rating	**fair**